SWRCB written testimony for the anadromous fish.
Brandes, 8/15/12

What additional scientific information should the State Water Board consider to inform potential changes to the Bay-Delta Plan relating to Bay-Delta fishery resource, and specifically pelagic fishes and salmonids, that was not addressed in the 2009 staff Report and the 2010 Delta Flow Criteria Report.

The status of the Chinook salmon stocks in 2010 and 2011 should be considered to inform potential changes to the Bay-Delta plan. Adult escapement in 2010 and 2011 for fall run Chinook salmon in the Central Valley have rebounded somewhat from the extreme low levels in 2008 and 2009 (Figure 1).

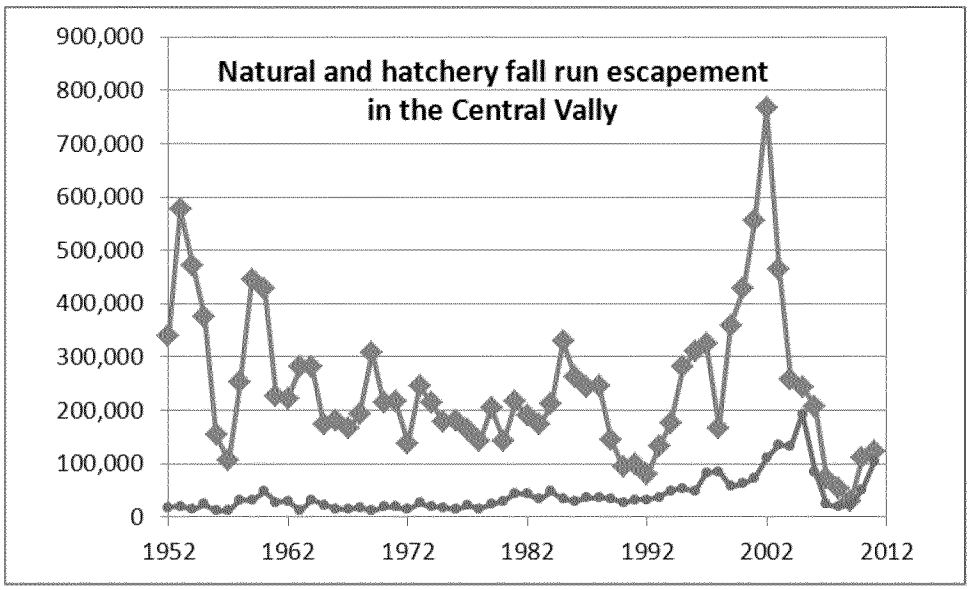

Figure 1: Natural (diamonds) and hatchery (circles) fall run escapement in the Central Valley between 1952 and 2011.

Average unmarked juvenile salmon indices between April and June at Chipps Island appear to be related to flow at Rio Vista (Figure 2). Other factors such as the prior year's escapement could also affect the indices. Preliminary analyses indicated that the relationship between flow and catch per cubic meter remained even after accounting for escapement (fall run from the Sacramento basin) except for those years with the lowest

escapement values (Newman, personal communication). Indices at Chipps Island only include unmarked juvenile salmon caught in the sampling so indices after 2007 contain less hatchery fish, relative to years prior to 2007 since 25% of the fall run hatchery production was marked starting in 2007. Although indices are lower since 2007, they appear to still increase with flow, with the highest abundances at 40,000 cfs at Rio Vista (Figure 3). There is also some evidence that on average, abundance is lower between 1993 and 2006 per unit flow at Rio Vista relative to the 1978-1992 period (Figure 3). It should be noted that these indices likely include some spring run, late-fall run and a few winter run juvenile salmon in addition to fall run salmon (Brandes, personal communication).

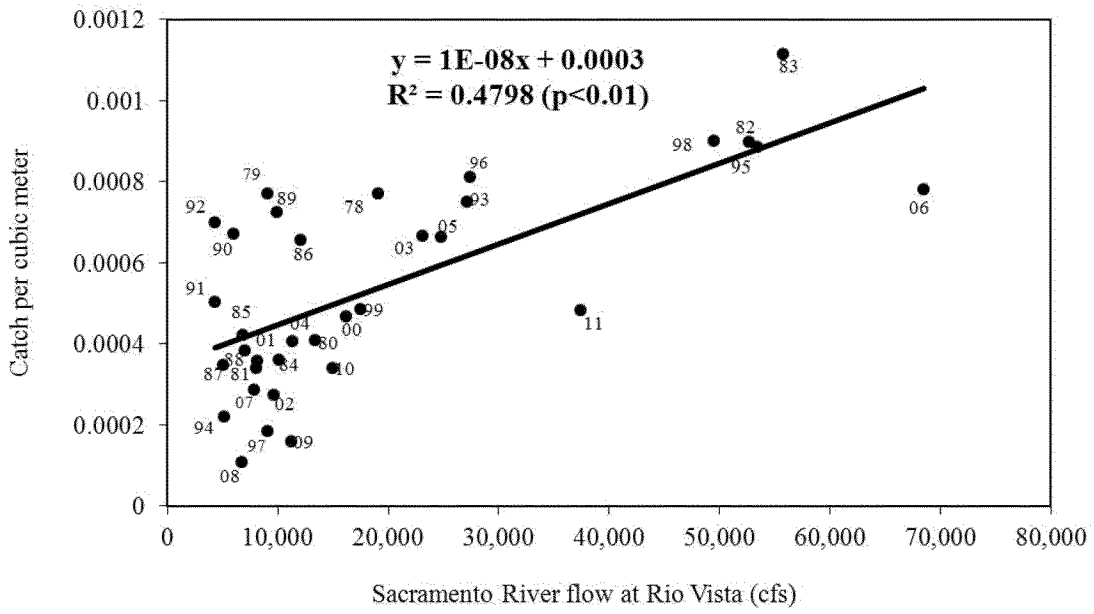

Figure 2: Mean catch per cubic meter of unmarked juvenile Chinook salmon in the midwater trawl at Chipps Island between April and June of 1978 to 2011 versus mean daily Sacramento River flow at Rio Vista between April and June in cfs.

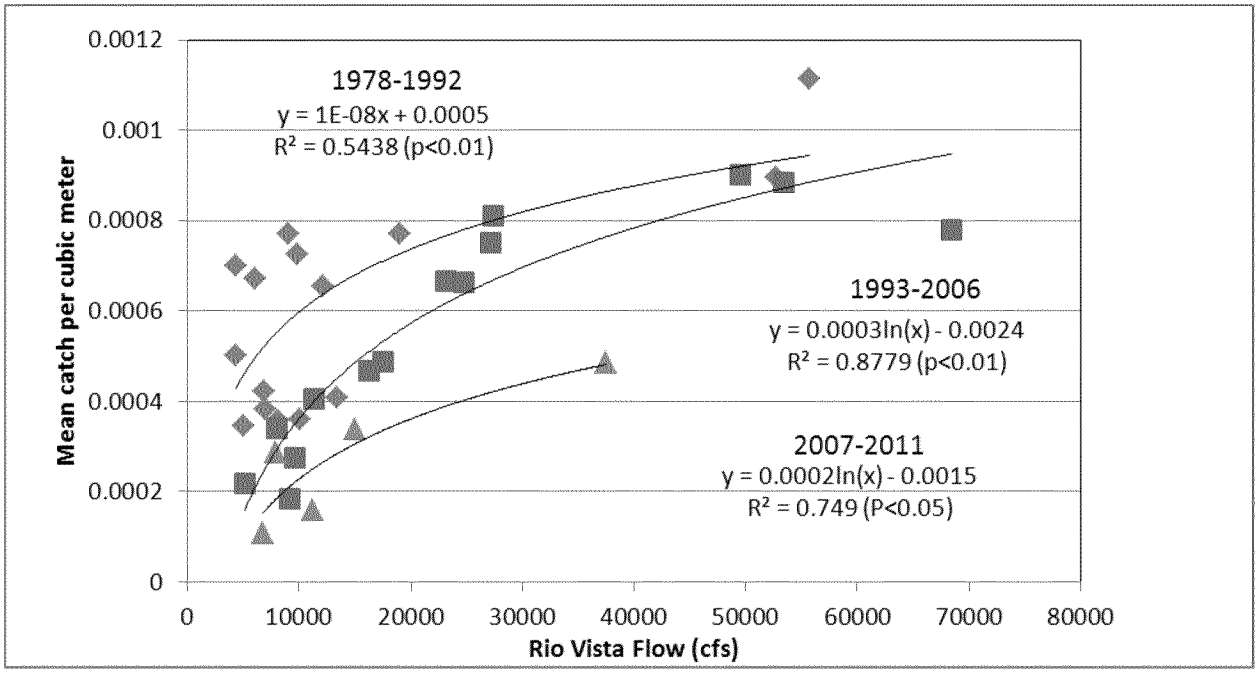

Figure 3: Mean catch per cubic meter of unmarked Chinook salmon in the midwater trawl at Chipps Island between April and June in three historical periods, and mean daily Sacramento River flow at Rio Vista between April and June.

We also suggest that the Board and board staff review the 2010 VAMP annual report (SJRG, 2011). Vernalis flows in May of 2010 were around 5000 cfs but did not provide the level of protection needed to achieve positive population growth by significantly improving salmon survival through the Delta. Smolt survival through the Delta in 2010 was estimated at 0.05– much lower than estimated on average historically (Figure 4). Comparisons of survival to common reaches between 2010 and 2009 indicate survival was substantially greater in 2010 than in 2009 (SJRG, 2010), but neither year had survival high enough to sustain the population. In our comments to the Board on the Review of and Potential Modifications to the San Joaquin River Flow and Southern Delta Salinity Objectives we concluded that an average of 0.50 survival through the Delta is needed (given average conditions in other phases of the life-cycle) to achieve the CVPIA's Anadromous Fish doubling goal in 9 generations (27 years), whereas a survival rate of 0.05 results in extinction in 4 generations (12 years)(DOI, February 8, 2011, page 18).

As the VAMP peer review panel identified, survival has been decreasing over time within a flow level (very low, low, moderate, high) (SWRCB 2010 b), thus the results of the analyses by AFRP and others, based on historical

relationships, may not afford high enough flows in the present or future. A 0.05 survival through the Delta in 2010, suggests unimpaired flows of 60%, which result in flows of over 5000 cfs at Vernalis approximately 85% of time, may not be high enough to assure positive population growth or to achieve the narrative salmon protection objective identified in the 2006 Bay-Delta plan to double the natural production of Chinook salmon from the average production from 1967 to 1991 consistent with the provisions of State and federal law.

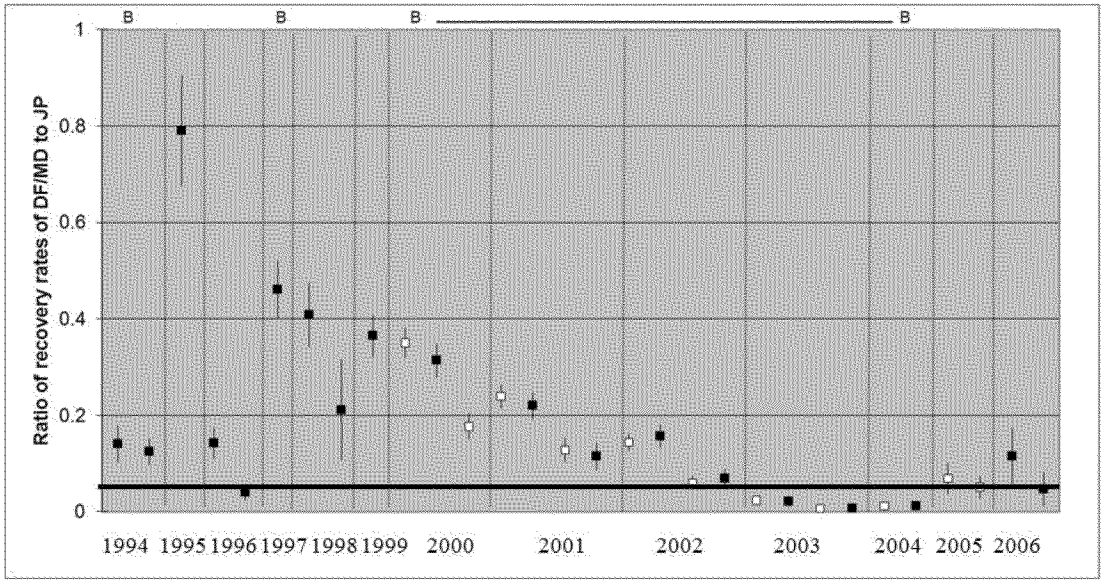

Figure 4: Estimates of smolt survival (+/- 2 Standard Errors) from Mossdale to Jersey Point during the VAMP between 1994 to 2006 using coded wire tagged fish. Years with the physical Head of Old River Barrier installed are denoted with B and are in 1994, 1997 and 2000-2004. The black line is the estimate of survival between Mossdale and Chipps Island in 2010 using acoustic tag technology and removing predator-type detections. (Brandes et al., 2008 and Brandes, personal communication).

Much of the information on survival associated with the VAMP was collected with a physical head of Old River barrier installed (2000-2004). The results from these years of data, in addition to past data gathered without a barrier, suggests the physical barrier resulted in higher survival at

any one flow than would have occurred without a barrier (SJRG, 2007). Survival through the Delta in 2010, with the non-physical barrier installed, did not result in survival as high as in the past when the physical barrier was installed at similar flow levels at Vernalis (Figure 5). These analyses suggest that survival will be further improved with a physical barrier at the head of Old River than it would be with a non-physical barrier or without a physical head of Old River barrier. FWS suggests including a provision for including a physical barrier in Old River, while still being protective of delta smelt, to increase the benefit of increased flows at Vernalis at flows up to 7000 cfs, or increasing the percent of unimpaired flow to be comparable to that on the Sacramento River (75%), such that flows of greater than 5000 cfs will occur more frequently than proposed. Given the trend of decreasing survival at any one flow level, continued monitoring of Chinook salmon survival is critical to assuring flow criteria and other management actions are resulting in survival rates that would result in increasing the Chinook salmon population in the San Joaquin basin and provide information for implementing adaptive management.

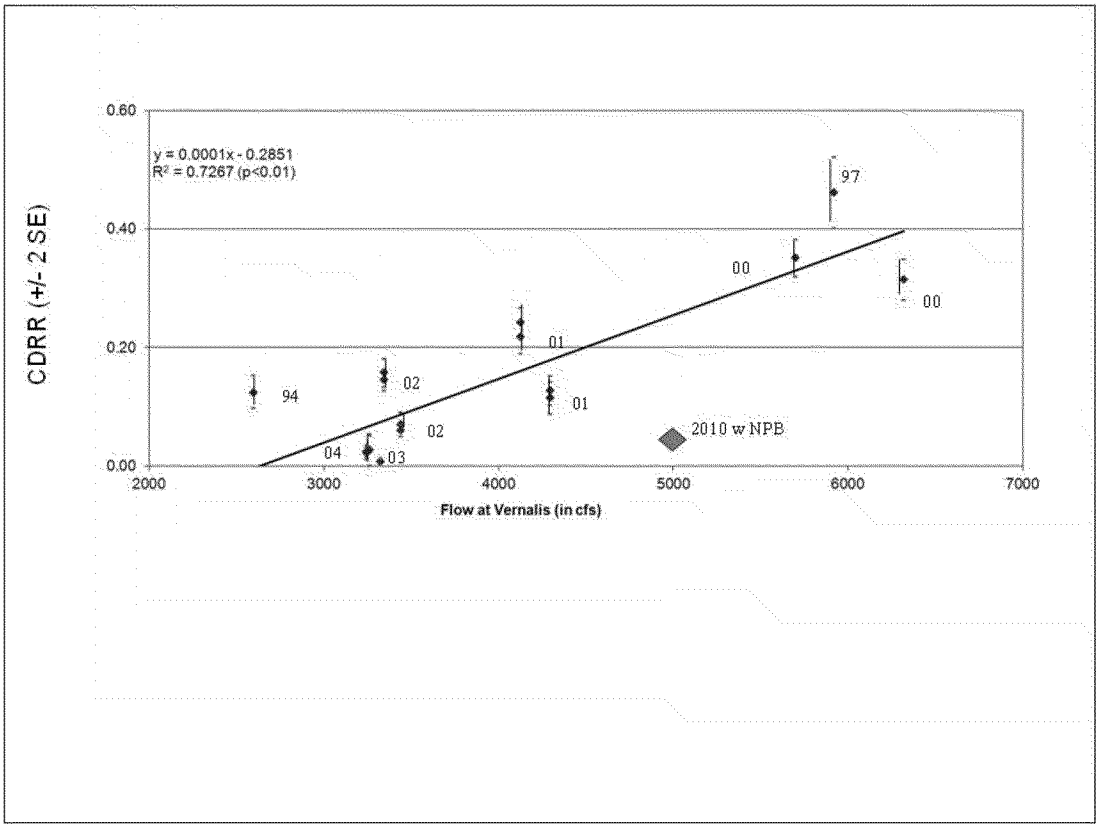

Figure 5: CDRR (point estimates of survival) plus and minus 2 standard errors using Chipps Island, Antioch and ocean recoveries, for groups released at Mossdale or Durham Ferry and Jersey Point in 1994, 1997, 2000-2004 and average flow at Vernalis in cfs for 10 days starting the day of the Mossdale release or the day after the Durham Ferry release with the HORB in place.

Once the VAMP agreement expired in 2011, the funding for estimating juvenile Chinook salmon survival through the Delta has been lost. In 2012, stop-gap funding was found from a variety of sources, but no such funding exists for 2013. While your 2009 staff report (page 31) identifies the VAMP monitoring as ongoing, it is no longer occurring. Monitoring of juvenile salmon survival in the San Joaquin basin has been occurring in most years since 1994 and provides a historical perspective of the range of estimated smolt survival through the Delta and is the basis for present modeling and BDCP evaluation. Additional monitoring of juvenile Chinook salmon survival is needed to further resolve the relationship between flow and exports and juvenile salmon survival through the south Delta with and without a HOR barrier or non-physical barrier. USFWS believes that continued monitoring of juvenile Chinook salmon survival in the San Joaquin Delta is critical to assessing present and future flow and

export/inflow criteria. Although the NMFS biological opinion mandates a 6 year acoustic study for steelhead, it will not have the 15 year historical record for perspective. In addition, there may be more complications evaluating steelhead survival to any one flow or export/inflow levels, due to residualization (non-migratory behavior) of steelhead juveniles. Studies in the south Delta conducted in 2011 and 2012 will provide additional information that the Board and board staff should review, but results are not yet available. In addition, a separate study in 2012 (DWR Stipulation Study), evaluating diversion of juvenile steelhead off the mainstem San Joaquin River to routes leading to the CVP and SWP, indicates many juvenile steelhead may be diverted toward the facilities even at Old and Middle River flows of -1250. These results from these studies should also be used in determining appropriate OMR levels to assure juvenile salmonids from the San Joaquin basin are able to migrate successfully through the Delta to Chipps Island.

Additional information on the benefits of the closing the Delta Cross Channel in the spring is covered in DFG's written comments for this workshop. In addition, additional information on the benefits of closing the Delta Cross Channel for up to 10 days in October to decrease straying of adult Chinook salmon returning to the Mokelumne River is provided in a Draft Environmental Assessment regarding a Delta Cross Channel Temporary Closure Multi-year Study (USBR, DOI, August 2012).

To fully endorse the concept of a natural flow regime, the SWRCB should consider setting Delta export to Delta inflow limits between July and September. Moyle and Bennett (2008), show the ecosystem has shifted from one benefiting native species to one dominated by non-native species from a change in the timing of freshwater in the Delta.

> "This shift presumably occurred as a result of the long-term (slow) process of steadily increasing pumping rates over time which requires the maintenance of freshwater conditions in the Delta during summer (Figure D.3), as well as the relatively rapid invasion by Brazilian waterweed and other factors that favored slough-resident (e.g., centrarchid species) and freshwater alien planktivore (e.g., inland silverside) fish assemblages. Species in these assemblages may suppress populations of desirable species through competition and predation (Bennett and Moyle 1996), and/or their expansion may reflect an overall shrinkage in brackish pelagic habitat required by native smelt and juvenile striped bass (Feyrer et al. 2007; Nobriga et al. 2008).
>
> This scenario is similar to those reported for temperate freshwater lakes where interactions between multiple processes operating at different temporal

> scales work together to shift a "desirable" clear-water regime with abundant aquatic vegetation and centrarchid fishes to an "undesirable" turbid-water regime with less vegetation and abundant planktivorous fishes (Carpenter 2003, Scheffer and Carpenter 2003, Folke et al. 2004, Rogers and Allen 2008). Once the shift to turbid water has occurred, it is very hard for the lakes to switch back to a clear-water state. (The obvious difference here is that the desirable regime for the Delta is the opposite of the one for temperate lakes.) The lake examples imply considerable ability for ecosystem states to persist even when the cause of the shift to a different state is removed. Likewise, even with a shift of the current water management strategy, it will be very difficult for the Delta ecosystem to shift back to the desirable regime (i.e., one with abundant pelagic native fishes) due to the habitat-stabilizing properties of the Brazilian waterweed and life history strategies (e.g. longer life spans) of the centrarchid fishes.
>
> Overall, the present state of the system will most likely continue as long as the Delta maintains its present configuration and water management practices. " (Moyle and Bennett, 2008, page 14).

How should the State Water Board address scientific uncertainty and changing circumstances, include climate change, invasive species and other issues?

DOI believes that the State Board should address scientific uncertainty and changing circumstances, including climate change, invasive species and other issues (BDCP), with a specific adaptive management plan. In our December 6, 2010 comments on the SWRCB's draft technical report we said "There is uncertainty in our understanding of how flow and salinity will affect future biological beneficial uses, consequently decisions must be made with uncertainty. Because of these uncertainties, any San Joaquin River flow objectives should be implemented, then evaluated and refined over time (adaptive management) to ensure the lessons learned are used to further refine the management of flows and salinity for meeting biological goals."

Specifically, what kind of adaptive management and collaboration (short, medium and long-term), monitoring and special studies programs should the State Water Board consider related to Bay-Delta fisheries as part of this update to the Bay-Delta Plan?

We suggest the Board review the most recent DOI publication on adaptive management where several examples of where adaptive management has worked is documented. The DOI publication: Adaptive Management: The U.S. Department of the Interior Applications Guide (Williams et al., 2012),

is in addition, to the previous DOI publication: Adaptive Management: The U.S. Department of the Interior Technical Guide (Williams et al., 2007). These two documents will help the Board and board staff identify key components of a successful adaptive management program. Both documents can be obtained at: http://www.doi.gov/ppa/Adaptive-Management.cfm. These documents are especially applicable to criteria where the scientific underpinnings need further study.

DOI supports the goals of the flow criteria: halting the decline and increasing populations of native species as well as species of commercial and recreational importance by providing sufficient flow and water quality at appropriate times to promote viable life stages of the species, but we believe specific biological indicators need to be incorporated to guide the monitoring and special studies program and adaptive management. For instance, biological objectives have been identified in the flow criteria report (2010) as:

1. Provide sufficient flow to increase abundance of desirable species.
2. Create shallow brackish water habitat in Suisun Bay
3. Provide floodplain inundation to enhance spawning and rearing opportunities.
4. Manage net OMR, reverse flows to protect sensitive life stages of desirable species.
5. Provide sufficient flow in the Sacramento and San Joaquin Rivers and East side streams, to transport smolts through the Delta during the spring to contribute to SWRCB salmon protection water quality objective .
6. Maintain water temperatures and DO in mainstem rivers that flow in the Delta that will support adult Chinook salmon migration, egg incubation, smolting and early-year and late-year juvenile rearing.

However, to fully evaluate the flow criteria, and adaptively manage it, specific biological and physical indicators need to be identified. For instance, how much increase in the abundance of desirable species is targeted? In addition, how will it be determined if sensitive life stages of desirable species have been protected by net OMR flows? Identifying what level of protection the SWRCB is targeting will help in knowing if it has been achieved and for adaptively managing the flow criteria to ultimately achieve those levels of protection. Monitoring (and funding for the monitoring) should also be identified to track the success or failure of the

flow criteria and for the basis of future adaptive management of the flow criteria. We do not see where these levels of biological and physical indicators have been identified. We have recommended evaluating an average of 0.50 survival through the San Joaquin River Delta for providing the needed survival through the Delta (given average survival in other aspects of the life-stage) for meeting the CVPIA doubling goals (DOI, 2/8/11, page 18). Similar goals and estimates of smolt survival should be developed for the Sacramento Delta. Also, catch per cubic meter at Chipps Island and Sacramento and abundance estimates at Mossdale provide historical measurements of juvenile production that can be compared to future indices. However, the SWRCB should not assume present monitoring will continue without some assurances.

While we support the Board's management objectives to:

1. Combine flow needs comprehensively,
2. Establish mechanisms to evaluate Delta environmental conditions, periodically review underpinnings of the biological objectives and flow criteria, and change biological objectives and flow criteria when warranted,
3. Review new research and monitoring to modify biological objectives and flow criteria,
4. not recommend overly complex flow criteria as not to infer a greater understand of specific numeric flow criteria than available science supports,

we suggest the Board further specify how these management objectives will be met.